

What is claimed is:

1. A substrate processing apparatus, comprising:

a substrate transfer section;

a plurality of modules, each of said plurality of modules  
5 being detachably attached to said substrate transfer section; and

first substrate transfer means provided in said substrate  
transfer section and capable of transferring a substrate or  
substrates to said plurality of modules,

wherein said plurality of modules are piled up, separately  
10 from one another, in a substantially vertical direction,

wherein each of said plurality of modules comprises:

a substrate processing chamber, having a hermetic  
structure, for processing said substrate or said substrates;

an intermediate chamber having a hermetic structure and  
15 being provided between said substrate processing chamber and said  
substrate transfer section;

a first valve provided between said substrate processing  
chamber and said intermediate chamber, said first valve being  
capable of establishing hermetic isolation between said substrate  
20 processing chamber and said intermediate chamber when said first  
valve is closed and being capable of allowing said substrate or  
said substrates to pass through said first valve when said first  
valve is opened; and

a second valve provided between said intermediate chamber  
25 and said substrate transfer section, said second valve being  
capable of establishing hermetic isolation between said

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intermediate chamber and said substrate transfer section when said second valve is closed and being capable of allowing said substrate or said substrates to pass through said second valve when said second valve is opened, and

5 wherein said intermediate chamber is provided with second substrate transfer means capable of transferring said substrate or said substrates to said substrate processing chamber.

2. A substrate processing apparatus as recited in claim 1, wherein each of said plurality of modules comprises:

10 said substrate processing chamber, having a hermetic structure of vacuum level, for processing said substrate or said substrates;

15 said intermediate chamber having a hermetic structure of vacuum level and being provided between said substrate processing chamber and said substrate transfer section;

20 said first valve provided between said substrate processing chamber and said intermediate chamber, said first valve being capable of establishing hermetic isolation of vacuum level between said substrate processing chamber and said intermediate chamber when said first valve is closed and being capable of allowing said substrate or said substrates to pass through said first valve when said first valve is opened; and

25 said second valve provided between said intermediate chamber and said substrate transfer section, said second valve being capable of establishing hermetic isolation of vacuum level between said intermediate chamber and said substrate transfer

section when said second valve is closed and being capable of allowing said substrate or said substrates to pass through said second valve when said second valve is opened.

3. A substrate processing apparatus as recited in claim 2, wherein said substrate processing chamber and said intermediate chamber can be independently reduced in pressure.

4. A substrate processing apparatus as recited in claim 1, wherein said intermediate chamber of each of said plurality of modules is further provided with substrate holding means capable of holding said substrate or said substrates, said substrate holding means being positioned closer to said substrate transfer section than said second substrate transfer means.

5. A substrate processing apparatus as recited in claim 1, wherein said substrate transfer section transfers said substrate or said substrates under atmospheric pressure.

6. A substrate processing apparatus as recited in claim 5, wherein said substrate processing chamber is a substrate processing chamber wherein said substrate is or said substrates are processed under a reduced pressure.

7. A substrate processing apparatus as recited in claim 1, wherein said substrate transfer section is further provided with a cassette holding means for holding a cassette capable of

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accommodating a plurality of said substrates, said first substrate transfer means being capable of transferring said substrate or said substrates between said cassette held by said cassette holding means and said plurality of modules.

5 8. A substrate processing apparatus as recited in claim 7,  
A wherein said first substrate transfer ~~means~~<sup>device</sup> is provided with a structure capable of transferring said cassette.

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10 9. A substrate processing apparatus as recited in claim 1,  
A wherein said substrate transfer section is further provided with  
an elevator capable of vertically moving said first substrate  
A transfer ~~means~~<sup>device</sup>.

15 10. A substrate processing apparatus as recited in claim 9,  
wherein said substrate transfer section is further provided with  
a cassette introducing section for transferring said cassette  
into said substrate transfer section and carrying out said  
cassette from said substrate transfer section, said cassette  
introducing section being disposed at a predetermined height  
which is different from the height of said cassette holding  
A ~~means~~<sup>device</sup>.

20 11. A substrate processing apparatus as recited in claim 1,  
wherein said substrate processing apparatus is capable of  
processing a plurality of said substrates simultaneously, and  
A said second substrate transfer ~~means~~<sup>device</sup> is capable of transferring

simultaneously the same number of substrates as said plurality of substrates to be simultaneously processed by said substrate processing apparatus.

5 12. A substrate processing apparatus as recited in claim 11,  
wherein said substrate processing apparatus is a plasma enhanced  
processing apparatus for processing said substrates utilizing  
plasma, said substrate processing apparatus includes second  
10 substrate holding means capable of holding said plurality of  
substrates with the substrates being laterally arranged side by  
side, and said substrate transfer means is capable of  
transferring simultaneously said plurality of substrates with the  
substrates being laterally arranged side by side.

15 13. A substrate processing apparatus as recited in claim 1,  
wherein said substrate processing apparatus is capable of  
processing a plurality of said substrates simultaneously, and  
said second substrate transfer means is capable of transferring  
said plurality of substrates one by one to respective their  
processing positions where said plurality of substrates are to  
be simultaneously processed.

20 14. A substrate processing apparatus, comprising:  
a substrate transfer section;  
a plurality of modules, each of said plurality of modules  
being detachably mounted to said substrate transfer section; and  
first substrate transfer means provided in said substrate

transfer section and capable of transferring a substrate or substrates to said plurality of modules,

wherein said plurality of modules are piled up, separately from one another, in a substantially vertical direction,

5 wherein each of said plurality of modules comprises:

a substrate processing chamber, having a hermetic structure, for processing said substrate or said substrates;

10 first and second intermediate chambers provided between said substrate processing chamber and said substrate transfer section, each of said first and second intermediate chambers having a hermetic structure, said first intermediate chamber being located closer to said substrate processing chamber than said second intermediate chamber, and said second intermediate chamber being located closer to said substrate transfer section than said first intermediate chamber;

15 a first valve provided between said substrate processing chamber and said first intermediate chamber, said first valve being capable of establishing hermetic isolation between said substrate processing chamber and said first intermediate chamber when said first valve is closed and being capable of allowing said substrate or said substrates to pass through said first valve when said first valve is opened;

20 a second valve provided between said first intermediate chamber and said second intermediate chamber, said second valve being capable of establishing hermetic isolation between said first intermediate chamber and said second intermediate chamber

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when said second valve is closed and being capable of allowing said substrate or said substrates to pass through said second valve when said second valve is opened; and

5 a third valve provided between said second intermediate chamber and said substrate transfer section, said third valve being capable of establishing hermetic isolation between said second intermediate chamber and said substrate transfer section when said third valve is closed and being capable of allowing said substrate or said substrates to pass through said third  
10 valve when said third valve is opened,

wherein said second intermediate chamber is provided with substrate holding means capable of holding said substrate or said substrates, and

15 wherein said first intermediate chamber is provided with second substrate transfer means capable of transferring said substrate or said substrates between said substrate holding means and said substrate processing chamber.

15. A substrate processing apparatus as recited in claim 14, wherein each of said plurality of modules comprises:

20 said substrate processing chamber, having a hermetic structure of vacuum level, for processing said substrate or said substrates;

said first and second intermediate chambers provided between said substrate processing chamber and said substrate  
25 transfer section, each of said first and second intermediate chambers having a hermetic structure of vacuum level, said first

intermediate chamber being located closer to said substrate processing chamber than said second intermediate chamber, and said second intermediate chamber being located closer to said substrate transfer section than said first intermediate chamber;

5           said first valve provided between said substrate processing chamber and said first intermediate chamber, said first valve being capable of establishing hermetic isolation of vacuum level between said substrate processing chamber and said first intermediate chamber when said first valve is closed and  
10           being capable of allowing said substrate or said substrates to pass through said first valve when said first valve is opened;

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15           said second valve provided between said first intermediate chamber and said second intermediate chamber, said second valve being capable of establishing hermetic isolation of vacuum level between said first intermediate chamber and said second intermediate chamber when said second valve is closed and being capable of allowing said substrate or said substrates to pass through said second valve when said second valve is opened; and

20           said third valve provided between said second intermediate chamber and said substrate transfer section, said third valve being capable of establishing hermetic isolation of vacuum level between said second intermediate chamber and said substrate transfer section when said third valve is closed and  
25           being capable of allowing said substrate or said substrates to pass through said third valve when said third valve is opened.



16. A substrate processing apparatus as recited in claim 15, wherein said substrate processing chamber, said first intermediate chamber and said second intermediate chamber can be independently reduced in pressure.

5 17. A substrate processing apparatus as recited in claim 14, wherein said substrate transfer section transfers said ~~substrate~~ ~~or said~~ substrates under atmospheric pressure.

10 18. A substrate processing apparatus as recited in claim 17, wherein said substrate processing chamber is a substrate processing chamber wherein said substrate is or said substrates are processed under a reduced pressure.

19. A substrate processing apparatus as recited in claim 14, wherein said substrate holding <sup>device</sup> ~~means~~ is a heat-resistant <sup>device</sup> ~~means~~ substrate holding ~~means~~.

15 20. A substrate processing apparatus as recited in claim 14, wherein said substrate transfer section is further provided with <sup>device</sup> ~~means~~ a cassette holding ~~means~~ for holding a cassette capable of accommodating a plurality of said substrates, said first <sup>device</sup> ~~means~~ substrate transfer ~~means~~ being capable of transferring said 20 substrate or said substrates between said cassette held by said <sup>device</sup> ~~means~~ A cassette holding ~~means~~ and said plurality of modules.

21. A substrate processing apparatus as recited in claim 20,  
wherein said first substrate transfer <sup>device</sup>~~means~~ is provided with a  
structure capable of transferring said cassette.

22. A substrate processing apparatus as recited in claim 14,  
wherein said substrate transfer section is further provided with  
an elevator capable of vertically moving said first substrate  
transfer <sup>device</sup>~~means~~.

23. A substrate processing apparatus as recited in claim 22,  
wherein said substrate transfer section is further provided with  
a cassette introducing section for transferring said cassette  
into said substrate transfer section and carrying out said  
cassette from said substrate transfer section, said cassette  
introducing section being disposed at a predetermined height  
which is different from the height of said cassette holding  
<sup>device</sup>~~means~~.

24. A substrate processing apparatus as recited in claim 14,  
wherein said substrate processing apparatus is capable of  
processing a plurality of said substrates simultaneously, and  
said second substrate transfer <sup>device</sup>~~means~~ is capable of transferring  
simultaneously the same number of substrates as said plurality  
of substrates to be simultaneously processed by said substrate  
processing apparatus.

25. A substrate processing apparatus as recited in claim 24,

wherein said substrate processing apparatus is a plasma enhanced processing apparatus for processing said substrates utilizing plasma, said substrate processing apparatus includes second substrate holding means capable of holding said plurality of substrates with the substrates being laterally arranged side by side, and said substrate transfer means is capable of transferring simultaneously said plurality of substrates with the substrates being laterally arranged side by side.

26. A substrate processing apparatus as recited in claim 14, wherein said substrate processing apparatus is capable of processing a plurality of said substrates simultaneously, and said second substrate transfer <sup>device</sup> means is capable of transferring said plurality of substrates one by one to respective their processing positions where said plurality of substrates are to be simultaneously processed.